

82 firms (mostly located in Moab), supporting 1,141 paid employees. Taxable retail sales, services, and business equipment purchases for Grand County amounted to \$159.6 million in 2000 (GPU 2003). Grand County and the city of Moab have experienced significant accommodations growth; lodging capacity increased from 612 rooms to 1,861 rooms (GPU 2003). As a result, the local tax base is heavily dependent on the level of tourism-recreation activity.

By contrast, San Juan County has a much smaller service sector supporting the tourism-recreation-based economy; in 1997, 38 firms provided accommodation and food services and employed 382 workers.

The annual payroll per worker for both Grand County and San Juan County (\$15,188 and \$16,464, respectively) remained well below state and national averages despite growth and development in the tourism-recreation economy. In Grand County, for example, the annual payroll per worker is only 59.3 percent of the state average and 49.6 percent of the national average. The percentages for San Juan County are somewhat higher than those for Grand County (64.3 percent and 53.8 percent), possibly because its service sector and underlying labor force are less dependent on tourism- and recreation-based activities.

Table 3–19 also provides information on farm-based enterprise in the two-county region. San Juan County had 231 farms in 1997 occupying over 1.6 million acres of land. On average, each farm contributed \$39,381 worth of farm products to the local economy, signifying the relative importance of farm-based activity in San Juan’s local economy. Farm-based activity in Grand County plays a relatively minor role in its local economy. In 1997, Grand County had 85 farms covering 76,000 acres of land and producing an average value of \$26,929 worth of farm products per farm.

The availability of land in Grand County for expanding economic activity is restricted, given the predominant role of state and federal governments in managing nearly 94 percent of Grand County’s total land area. For example, only 4.3 percent of the land in Grand County is privately owned; most of the remaining land is managed by the federal government (71.7 percent), owned by the state (15.5 percent), or held in trust as American Indian tribal land (4.4 percent). Other land stakeholders in Grand County include the USFS (1.2 percent) and the U.S. Department of Defense (0.08 percent) (GPU 2003).

3.1.19 Human Health

Human health at and near the Moab site is influenced by the radiation sources in the environment and the contaminants associated with the mill tailings at the site. Exposures occur to occupational workers and members of the public that may live near or recreate adjacent to the site. This section evaluates the potential risks to human health at the Moab site. Appendix D presents a detailed evaluation of the risk to the public.

3.1.19.1 Natural Radiation Environment

Everyone is exposed to three types of ionizing radiation: (1) natural sources unaffected by human activities, (2) those of a natural origin that are affected by human activities, and (3) man-made sources. Natural sources include cosmic radiation from space and naturally occurring radionuclides in soils and rocks. The tailings pile at the Moab site is an example of radiation from a natural origin that has been affected (concentrated) by human activities. Man-made sources include nuclear medicine, medical x-rays, nuclear fallout, and consumer products.

For most of the population, natural background radiation is the largest contributor to their overall radiation dose. The natural occurrence of cosmic radiation and radionuclides at the earth's surface varies throughout the world and depends mostly on the altitude where the exposure occurs and the nearby geology. Cosmic radiation consists of charged particles (primarily extraterrestrial) that generate secondary particles that have direct and indirect ionizing properties. The main radionuclide contributors to external terrestrial gamma radiation are potassium-40 and the members of the thorium and uranium decay series. Impacts (terrestrial gamma and radon gas and its decay products) are mostly from the top several inches of soil.

3.1.19.2 Current Risk to Members of the Public

To evaluate current risk to members of the public, the region of influence is considered to be a 50-mile radius of the Moab site ([Figure 3–22](#)). The estimated population in this region is approximately 11,000; most of this population lives within 10 miles of the Moab site.

The majority of the affected population lives in Moab, which is approximately 3 miles from the site. According to the 2000 census, the population of Moab was 4,779. The primary individuals exposed to contaminants at the Moab site are the nearby residents (the closest residents live adjacent to the site approximately 2,200 ft from the tailings pile) and recreational users of land adjacent to the site. Recreational users include Moab residents and tourists. The major recreational activities near the site are rafting on the Colorado River and camping on adjacent lands. Although some minor trespassing has occurred since DOE began managing the Moab site, no members of the public are receiving prolonged exposure to on-site contaminants.

The site contaminants consist of both radioactive and nonradioactive components (e.g., heavy metals). Because members of the public do not have access to the site, essentially all the risks are associated with the radioactive contaminants through exposure to gamma radiation and inhalation of radon gas.

[Table 3–20](#) summarizes the potential dose to members of the public from the radioactive contaminants at the Moab site and from other sources (natural and man-made). This table provides three types of risk numbers. Two sets of numbers are site-related, and the third is an average radiation risk for the U.S. population from natural radiation sources. Site-related risk information is provided for the types of activities that currently occur near the site (rafting and camping) and for the individual who lives closest to the Moab site (the maximally exposed individual). Table 3–20 indicates that the most significant contribution to total dose comes from background sources, not from the Moab site.

Table 3–20. Annual Doses From Background Radiation (Millirem per Year) Compared to Doses From Radon and Gamma Associated With Tailings at the Moab Site

Scenario	Central Tendency ^a (site related)		Background (U.S. average)	Total	RME ^b (site-related)		Background (U.S. average)	Total
	Radon	Gamma			Radon	Gamma		
Camping	15.0	4.0	300	319.0	30.0	7.9	300	337.9
Rafting	7.4	1.6	300	309.0	11.1	2.4	300	313.4
MEI ^c	105.7	16.0	300	421.7	132.3	20.0	300	452.3

Notes: mrem/yr = millirem per year. The backup assumptions and calculation sheets are presented in Appendix D.

^aCentral tendency risks are based on more typical exposure assumptions that are still somewhat conservative. Exposure assumptions include the time spent in contaminated areas and the amounts of contaminated material ingested that have a direct impact on the estimated risks.

^bRME = reasonable maximum exposure.

^cMEI = maximally exposed individual (the resident closest to the site).

The two types of site-related risks are based on (1) typical exposure assumptions (called central tendency exposures [e.g., amount of contaminated soil accidentally ingested, number of days camping next to the site]), and (2) exposure assumptions that tend to reflect the worst case and result in high-end risks (called reasonable maximum exposures [RMEs]). These high-end risks are based on conservative exposure assumptions resulting in high-end risk estimates. Exposure assumptions include factors such as the number of days spent camping at a site. The site-related exposure doses are based on time spent near the site-related contamination. Details on the assumptions and the calculation approach are presented in Appendix D.

The background doses listed in Table 3–20 summarizes the potential dose to members of the public from the radioactive contaminants at the Moab site and from other sources (natural and man-made). This table provides three types of risk numbers. Two sets of numbers are site-related, and the third is an average radiation risk for the U.S. population from natural radiation sources. Site-related risk information is provided for the types of activities that currently occur near the site (rafting and camping) and for the individual who lives closest to the Moab site (the maximally exposed individual). Table 3–20 indicates that the most significant contribution to total dose comes from background sources, not from the Moab site.

Table 3–20 shows the radiation levels that occur from natural sources such as cosmic rays and natural radioactive materials in the earth. Actual background radiation doses vary with location. In the case of the Moab site, data for Blanding, Utah, were used. The natural background doses assume exposure for an entire year. The *Final Environmental Impact Statement for Remedial Action Standards at Uranium Processing Sites* (EPA 1982) provides more information on the radiation standards.

3.1.19.3 Existing Occupational Risks

DOE contract personnel are on the site Monday through Thursday, except on holidays. On-site personnel conduct maintenance and environmental characterization activities. Maintenance activities include controlling dust using calcium chloride or water spraying, repairing the tailings pile after major precipitation events, and removing process-related material from the site.

Environmental characterization includes collecting samples of soil, ground water, and surface water; conducting gamma surveys of the surface soils; installing ground water monitor wells; conducting land surveys; and conducting vegetation surveys.

Table 3–21 summarizes the 2002 annual personnel exposure report for those employees with a measurable dose.

Table 3–21. 2002 Annual Personnel Exposure Summary Report

Employees with Measured Dose	External Dose (gamma) (mrem/yr)	Internal Dose (whole body from radon) (mrem/yr)	Total Effective Dose Equivalent (mrem/yr)
1	0	31	31
2	0	145	145
3	0	150	150
4	13	60	73
5	10	160	170
6	0	115	116
7	0	567	567
8	13	40	53
9	0	216	216
10	0	186	186
11	13	122	135
Average	4.5	163	167

Eleven other employees that participated in the personnel dose monitors did not have any measurable doses. This table indicates that the most significant dose contribution is from the ingestion of radon gas and that doses to workers vary considerably. All doses are below DOE benchmarks of up to 5,000 mrem per year (mrem/yr).

3.1.20 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629), directs federal agencies to identify and address, as appropriate, any activities that may affect minority and low-income populations. Minorities are members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, and Native Hawaiian or Other Pacific Islander. A minority population has been defined as a group in which minorities represent more than 50 percent of the population. Low-income populations are groups with an annual income below the poverty threshold.

Table 3–22 presents the minority and low-income populations in Grand and San Juan Counties. A portion of the Uinta and Ouray Indian Reservation is located in northern Grand County. The Ute Mountain (White Mesa Utes) and the Navajo Reservations are situated along the southern border of San Juan County, and American Indians make up the majority of the population in San Juan County: 57 percent of the 14,413 population base. The Hispanic population in Grand County represents the next largest minority population in either of the two counties (5.6 percent).

Table 3–22 also presents the percentage of persons below the poverty line as defined by the U.S. Department of Commerce. San Juan County has a relatively large percentage of individuals below the poverty line (30 percent) compared to Grand County (18 percent). The county poverty trends from 1989 through 1997 show that the percentage of the population falling below the poverty level increased by 34 percent in Grand County and decreased by 10 percent in San Juan County during that time.